

II. *Illustrations of the male terminal segments and armatures in thirty-five species of the Hymenopterous genus Colletes.* By the Rev. FRANCIS D. MORICE, M.A., F.E.S.

[Read December 3rd, 1903.]

PLATES VI, VII, VIII, AND IX.

IT has long been known that the "armures copulatrices" of *Colletes* ♂♂ yield remarkable specific characters. Mr. Saunders's *Synopsis* (*Trans. Ent. Soc.*, 1882) figured them for the six British species then known, and in 1891 (*Hor. Soc. Ent. Ross.*, xxv) Radoszkowski published a "Révision," with two Plates, representing in all about twenty palæarctic species.

It is so hard to find really satisfactory specific characters in this genus, that Radoszkowski's work might have been extremely useful if its execution had been somewhat more careful. But even the best of his figures are far too slight and diagrammatic to give an adequate idea of the very complicated objects which they represent. Certain features of these—not always the most characteristic—are emphasized and even exaggerated in his figures, but so many others are ignored that the total impression conveyed to us is often quite unlike that made by the objects themselves. (The manner in which he deals with the *bases of the sagittæ* in these figures is particularly unsatisfactory—the two or three hard lines on a flat field which are meant to suggest their shape being never adequate for that purpose, and sometimes really unintelligible.) Occasionally some attempt is made in the text to explain the characters which the author meant to indicate in his figures, but these explanations often by no means suffice to clear up doubts and difficulties produced by the lack of suggestiveness in the figures themselves. And it must be said further that the "new species" brought forward in this Revision are very poorly characterized, and that his identifications are often questionable, and sometimes certainly wrong.

I am as convinced as Radoszkowski himself can have
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been, that Colletes ♂ armatures have usually characters of their own, by which the species can be certainly, and sometimes easily, recognized. But these characters do not depend simply on the outlines assumed by certain portions of the structure in certain positions. Those outlines are often only the somewhat illusory and variable *horizons* of solid objects viewed accidentally in this or that aspect, they depend partly on the focussing adopted, partly on the position of the armature as a whole, and partly on that of each different part of it in relation to the others. This last may depend on a variety of accidents, since the parts are not all equally rigid, so that one or more of them may easily be somewhat distorted or displaced by causes which leave the rest of the structure unaffected. I do not think that Radoszkowski sufficiently realized this fact, which in itself seems to render his diagrammatic way of treating the subject inapplicable. Besides this—or perhaps because of it—he seems too ready to content himself with noting certain arbitrarily selected details, which are often not sufficiently distinctive to bear the weight he lays upon them. Other parts of the structures he dismisses—one might almost say, impatiently, giving the impression that he had studied them not at all or only in certain species. Thus he says that the *volsellæ* “ne présentent aucune particularité,” which is quite curiously untrue in this genus, though no doubt their position renders it difficult to make much use of the characters exhibited in them. And in speaking of the *couvercle génital*, as he calls it, he *defines* it in the introductory part of his paper as composed of “two pieces, the *sixth*” (!) “and *eighth* segments”; but he *figures* it both there and afterwards (in the only two cases where he figures it at all) as consisting not of these two segments, nor of either of them, but simply of the *seventh* ventral-plate! This is the more curious, because in his earlier paper on the *Mutillides* (1885) he says quite correctly, that the *couvercle génital* has been shown by Mr. E. Saunders to consist of the seventh and eighth ventral plates; and he figures accordingly, as such, those two plates (clinging together as they often do) both there, and also in a paper published a year later (Hor. Soc. Ent. Ross., xx, 1886). It would seem, then, that between 1886 and 1891—the date of the “Révision”—he must have somehow lost interest in the *couvercle*, or he would hardly have blundered about its composition as stated above. He adds one further

remark in the Revision, and one only, on the *couvercle génital*: viz. that its "form appears to be stable." That, if he means what I suppose him to mean by it, is doubtless true: but it certainly cannot be said to exhaust the subject, nor to indicate that the author had studied it carefully throughout the genus he was revising.

Perhaps the best thing in Radoszkowski's "Révision" is his recognition of a distinct group of species in which the stipites of the armature are simple, *i. e.* not divided by a deep sulcation into two apparently distinct portions—an apical and a basal. This is an easy character to see, and I think it is an important one, though I do not believe that all the other species—those with "divided stipites"—should also be regarded as forming a single group. The species with simple stipites are certainly, to some extent, united by other characters also; and I believe that they are confined to the warmer parts of the palæarctic region. None of them occur in Great Britain, nor, apparently, in Scandinavia. On the other hand, species with divided stipites are found throughout the whole region, and among them are some which seem to have hardly anything else in common (e. g. *cunicularius* and *fodiens*). Still, if it be necessary to classify *Colletes*-armatures *dichotomically*, this is perhaps the best "fundamentum divisionis" with which to start. And, as far as I know, Radoszkowski was the first to point it out.

But to return to the subject of the above-mentioned "seventh ventral plate"; it was, I think, particularly unfortunate that Radoszkowski, when dealing with *Colletes*, should have dismissed it with such slight and inaccurate treatment, instead of figuring it—or at least describing its form—in each of the species with which he dealt. For, in fact, this segment is generally at least as characteristic for specific purposes as the "armure" itself, and its characters are (for reasons presently to be given) easier both to recognize, to figure, and to describe. One chief object of this paper is to call attention to the very distinctive forms assumed by this segment in different species, and I figure it accordingly, together with the armature, in such palæarctic species as I possess—thirty-five in all—and likewise in an American species, which I cannot name, but which differs evidently from any of them, communicated to me from Massachusetts by Prof. C. T. Bruce of New York. (See Pl. IX, 57, 58.)

Though I am far from feeling competent to attempt a complete monograph of palæarctic *Colletes*-spp., I hope I may render some service to the future monographist by publishing along with these figures some notes on the insects examined, and a synoptic table of such further distinguishing characters as I have been able to find in their external structure. There does not, I believe, exist as yet any work which deals with nearly as many species as now lie before me. My materials have been partly collected by myself in England, France, Germany, the Alps, and nearly all countries round the Mediterranean, including Algeria, Egypt, and Syria; partly received from various friends and correspondents, especially Professor Perez, Dr. Schmiedeknecht, and Messrs. Friese, Kohl, Alfken, Vachal, and Edward Saunders. To Professor Perez above all—with whom I have been throughout in constant communication, and who has supplied me most liberally with material, including many of his own new species—any value that my work may have will be chiefly due.

With regard to one of the great difficulties connected with this genus, the obscure and entangled state of its "synonymy," I must say at once that I can do almost nothing to remove it. The original descriptions of their species by early authors are nearly always quite insufficient to fix their identity for certain, and I have had no opportunity for examining any "types" of them that may still exist. In calling species, therefore, by the old and familiar names of *succinctus*, L., *ligatus*, Er., etc., I express no opinion of my own as to the correctness of these identifications, but merely accept what I take to be the view generally current among hymenopterists. Even when I have reason to doubt this view, though I shall say so, I shall not always discard the name that is commonly adopted. Such insects as are unknown to any of my correspondents I shall treat as "new species," even if I know some old vague description to which they might possibly be referred. I think that, as matters stand at present, less confusion will be created by employing a name that may ultimately have to sink as a synonym, than to fix an old name on to a species to which it does not really belong. What I aim at is to ascertain, as far as I can, how many real species lie before me, and how they may be distinguished from one another. How they are ultimately to be called in our lists is another question, which must be

settled by the future monographist of the genus, and to him I leave it. Still I *do* occasionally mention points which seem to me deserving to be considered when that question comes up for definite settlement.

Let us now consider in a general way (*a*) the concealed abdominal plates in *Colletes* ♂ ♂, and (*b*) the armature proper.

The concealed abdominal plates.—Of these some are dorsal, some ventral. They all lie, normally, enclosed within the apex of the abdomen and immediately adjacent to the "armature." To this, I believe, they both act as a protective sheath, and also in some way co-operate with it in its special functions (clasping, etc.). For these purposes they are always extraordinarily modified from what we must suppose to have been their original form, viz. that of semi-annuli. And it may be noticed here, that at least on the ventral side this sort of modification commences in a rudimentary way even in the preceding (unconcealed) segments. The sixth, especially, when mounted in balsam and rendered semi-transparent, is seen to be far from uniform in its structure and chitinization, and is often tuberculated and foveated in a manner which probably bears some relation to the forms of the organs underlying it. (Cf. Pl. IX, figs. 49, 50, 52, 53.)

From between the armature and the seventh *dorsal* plate may be extracted (though seldom unbroken) the object which I figure in Pl. IX, 40. This, following Dr. E. Zander, I take to consist of a pair of dorsal plates—the eighth and ninth of the abdomen reckoning from the constriction, *i. e.* exclusive of the propodeum. I have not found any specific characters in them; and they are so extremely fragile and difficult to study, that I confine myself to figuring a single successful extraction of them.

The concealed *ventral* plates are the seventh and eighth of the abdomen (exclusive of the ventral plate, if such exists, which answers to the propodeum—I have never succeeded in finding any trace of one!).

The eighth plate seems very similar in all species. (See Pl. IX, 44.) It has none of the paradoxical variations of form which make this segment so characteristic in some species of *Prosopis*, *Andrena*, etc.

The seventh ventral plate, however, is a most interesting and surprising object. Its base is a ribbon-like strip or arch of chitin, joined at each end to the corresponding

dorsal plate. Springing from the apex of this arch appear nearly always two large symmetrical lobes or "wings." They are perfectly colourless and membranous at the extreme apex, still membranous, but more or less infuscated, punctured, and pilose on the disc, evidently chitinized at the base and along the inner margin, and at least somewhat thickened and darkened on the exterior margin. Each of them consequently has the appearance of a frail membranous sheet stretched on a more solid framework, which supports it much as the costa and nervures support a wing.

The form, colour, and pilosity of these lobes differ specifically to such an extent, that many species can be distinguished at a glance by these characters alone. Not only the actual outlines, but even the minute veinings, cloudings, etc. of the membrane seem to be extremely constant. The only difficulty in examining them is that they are apt to curl over somewhat at the apices laterally, but even this curling sometimes contributes to their specific "facies." I have frequently dissected many specimens of one species from widely-different localities, and have nearly always found their seventh segments exactly similar, and quite unlike that of any other species. The cases in which two different species have this plate deceptively similar, are extremely rare; and curiously enough, where this *does* happen, the insects themselves are generally very unlike each other in external characters.

These segments have, for examination, at least one great advantage over the armatures proper. Their outlines are real *margins* and not mere variable *horizons* of solid figures, hence their appearance is much less affected by slight differences of position. Also being much less complicated objects, and less troublesome to focus under the microscope (being flatter), they produce an impression which is more quickly grasped and more readily remembered.

It is perfectly easy, with a little practice, so to prepare either fresh or relaxed specimens as to display this segment sufficiently for all practical purposes; or it can be actually removed and mounted separately without any noticeable disfiguring of the specimen, but in that case the ligaments connecting it with the dorsal plate must be severed cautiously first. In nearly all cases it forms a most beautiful microscopic object, whether it be mounted dry or in balsam.

In certain cases (cf. my last figures on Pl. VIII) a very singular appearance is given to this segment by a tendency which the lateral thickened portions or "costæ" show to *detach* themselves from the lobes and stand up as separate tooth-like or spine-like processes. This leaves the lobes comparatively unsupported (cf. fig. 33*a*), or they may even disappear almost entirely, so that only a sort of skeleton of the segment remains to represent it (fig. 35*a*). One can trace, I think, a regular gradation in this respect—the likeness of the modified segment to the simple *semi-annulus*, from which it must have developed, decreasing stage by stage, till it vanishes altogether.

It is curious to note how in different genera of the Anthophila nature seems to select different ventral segments of the ♂ for paradoxical specific modification—the sixth in certain *Osmiæ*, the seventh in *Colletes*, the eighth in *Andrena*, both the seventh and the eighth in *Prosopis*—while in other cases none of these segments are particularly characteristic, and it is the armature itself which supplies the best specific characters (*c. g.* in *Bombus* and *Sphecodes*). I have already noted that these modifications are not confined wholly to the concealed portions of the abdomen; and indeed I suspect that its entire structure (the *emboîtement* of all its segments, the development of ventral tubercles on some of them, the usual acuniation and occasional peculiar armature of its apex, etc.) depends a good deal on the same sort of causes, which have diverted the concealed ventral segments from their original function as a part of the insect's integument, and made them a sort of appendage to the *armatura copulatrix*.

We come now to the "armature" proper, which comprises at least three obviously distinct portions, viz. its cushion-like base—the *cardo*, and two objects, each resembling a pair of forcipes, one within the other—the outer of which (following Thomson and Saunders) I call the *stipites*, and the inner the *sagittæ*.

The *cardo* has little character, and need not detain our attention; but the *stipites* and *sagittæ* are very differently formed in different species, and undoubtedly give to some armatures a peculiar and easily recognizable facies. Yet it is often not easy to define exactly the characters on which the peculiarity depends. This is partly because these organs, being practically very irregular figures of three dimensions, completely alter their appearance, when

the aspect in which we view them is even slightly changed. Consequently, to get a real idea of their structure we must look at them all round, and the more we do this the more we find that the characters which strike the eye at once in some particular aspect can no longer be recognized if the point of view be ever so slightly changed. (For this reason, as well as because of its comparatively simple character, I greatly prefer the characters of the seventh segment to those of the armature—they are both more positive, and more recognizable in different positions of the object.)

However, let us suppose that an armature is lying perfectly flat before us with its dorsum uppermost, and see what characters may be then observed in it.

First, as to the *stipites*. Each of these will generally appear more or less evidently three-jointed. There is a pilose, somewhat palpiform, and often pale apex—a longer and much broader *central* portion—and (separated from the last by what looks like a transverse suture) a large sub-triangular or sub-reniform *basal* lobe—bulging inwards so as to meet the corresponding lobe of the other stipes below the *sagittæ*.

This is the commonest type, and when it occurs we can take into account the forms of the three apparent joints which compose the stipes; the comparative length and breadth of each (individually or as compared with the other two); the straightness, convexity, situation, etc., of their outlines; the extent, density, and length of the pilosity at the apex, etc. In all these points the stipes of a particular species will present characters which seem to be constant, and will help to distinguish it.

In other cases, as Radoszkowski has pointed out, we can see no suture defining the basal portion of the stipes. In some such armatures the pilose apices are exceedingly long and narrow; in others much less so. The pilosity in this group is generally very much developed, and differs a good deal in its arrangement in the different species.

Next as to the *sagittæ*, we see—or rather seem to see, for the appearance is very different from the reality—two strips or rods of chitin lying side by side, dilated at the base into lobes which are sometimes sharply angled laterally, while their apices generally look pointed and sometimes divergent. To each of these rods laterally is attached a sort of membranous “wing” or “sail,” called by Radoszkowski the “fourreau,” not flat, but bent and folded

in various ways—sometimes looking much longer than the rods, sometimes not so—in some parts quite glassy, but in others often more or less dark and opaque. Besides these “wings” the rods may, or may not, have other lateral appendages or dilatations of rather thicker and darker substance, and these sometimes give the impression of a sharp triangular tooth projecting over the base of the more transparent “wing.”

“Characters” presented by the *sagittæ* in this aspect are—the outline and extent of the basal dilatation of the “rods”; the shape, size, colour, and foldings or twistings of the membranous “wings”; the presence or absence of a *secondary* (often tooth-like) *dilatation* of the rods as above described (between their *basal* dilatation and the “wing”); the length of the *sagittæ* as a whole in proportion to that of the *stipites*, etc. But all these characters are liable to become—I will not say *impossible*, but *difficult* to recognize if the organs are (as often happens) accidentally shrunk or displaced ever so little, or if the armature as a whole is not lying in exactly the proper position. I must repeat, therefore, that, for practical purposes, I greatly prefer the characters of the seventh segment.

As soon as we begin to examine the armature in other points of view than the direct dorsal aspect, we shall find that the description given above of the *stipites* and *sagittæ* requires a good deal of modification. Thus, looking at the *stipites* (Plate IX) sideways, we see at once that they are never really three-jointed, but composed of a single curiously-folded sheet, which is nearly but not quite completely chitinized throughout; the apices look no longer in the least palpiform, but more or less broadly triangular; the supposed suture dividing the stipes transversely is seen to be merely a superficial though often deep sulcation in it, etc. Again, looking sideways at the *sagittæ* (Pl. IX), we find that the dorsal view has not shown us their real apices at all—the latter are so sharply deflexed, that when we viewed the organ dorsally they were completely out of focus, and in fact out of sight. We have also to correct our former impression of the “wing” as something distinct from the “rod,” and attached to it as a sail to a mast—it is really nothing but a difference in the degree of chitinization which makes them look distinct objects. The truth seems to be that each *sagitta* consists of a single sheet of substance, folded and “crinkled” up in a complicated

fashion (especially towards its base), and much more thoroughly chitinized in certain places (especially along its inner margin and all over its basal part) than elsewhere. All the appearances in it of tooth-like processes, etc., are really produced by *foldings* of the substance, foreshortened in various ways according to the point of view. In fact the whole apparent structure of the object as viewed in the flat field of a microscope is simply a mass of optical illusions. Still the phenomena themselves, however deceptive, are *constant* in each species, and can therefore be used to furnish us with specific characters, if we have sufficient familiarity with microscopic work not to be misled by the εἶδωλα of the "optic glass."

When the armature is viewed from behind, a curious object with a bifid or bilobed apex appears to protrude from the inner side of each stipes, close to and partly covering the bases of the sagittæ. This is called the *volsella*. It has in some points of view the appearance of a distinct organ, partly imbedded in the stipes, but I think it is really only a peculiarly folded portion of the stipes itself—at any rate I have never succeeded in removing it without bringing away part of the stipes with it. The lobes at its apex differ in shape and size a good deal in different species (Pl. IX, 41, 42, 43), and might give good characters if they were more conveniently placed for examination. Sometimes they are pretty conspicuous even in the dorsal view of the armature, but more usually they are hidden by the dilatations of the sagittæ. The opposing faces of the lobes seem to be covered with rasp-like denticulations or tubercles, and I think they must have some prehensile function, but they do not seem to have any power of movement apart from that of the *stipes* as a whole.

The armatures which I have figured are rendered semi-transparent by immersion in Canada balsam. This causes a pair of divergent rod-like, perhaps tubular, objects to be seen indistinctly through the surface of the stipites, which on dissection are found to proceed from the bases of the sagittæ, and are part—I suppose—of the apparatus by which the latter are moved. (I have not attempted to take characters from them, as they cannot be seen without special preparation of the armature.)

Such of my figures as represent neither armatures nor seventh ventral plates are intended to render more

intelligible the Tables now to follow, in which I do my best to distinguish the ♂♂ of such palæarctic *Colletes*-species as are known to me by such characters only as can be seen without dissection.

I am bound to say at once, that I think we can hardly expect quite satisfactory results from an inquiry which begins by setting aside the most positive marks of difference which Nature has stamped on the creatures we are endeavouring to distinguish. Therefore it does not surprise me that, after attempting to deal with the matter under such limitations, the results I have reached do not even to myself seem very satisfactory. However, such as they are, I will offer them to my readers.

Apart from colour (including that of the pilosity, which depends a good deal on the condition of the specimen, and sometimes on other causes than that of specific identity), the most conspicuous differences that I see between one *Colletes* ♂ and another lie in (*a*) size; (*b*) surface sculpture of the body, especially its puncturation; (*c*) the structure and proportions of certain parts of the insect, especially the head, the antennæ, and the legs; and perhaps also in certain cases (*d*) the infuscation or the reverse of the wings, including their nervures.

Of these, the size of the insect is only in certain cases of much use in "determining" it. The average size of most species, when one is compared with another, differs little; and particular specimens in all of them may be much larger or smaller than the average. Of course the biggest *nanus* is much smaller than the smallest *nasutus*; but out of a mixed lot of (say) *succinctus*, *fodiens*, *montanus*, *picistigma*, and *daviesanus*, the biggest specimen and the smallest might equally belong to any of the species.

The sculpture-characters are much more to be trusted, but they are extremely difficult to describe in unmistakable terms:—*e.g.* such an expression as "fine puncturation," a "close puncturation," conveys different ideas to different minds, and even to the same mind at different times. Each reader measures such expressions by a standard of his own, and even that standard is liable to vary.

In the shape and relative proportions of the head, etc., we do at last arrive at characters which can be stated *positively*. But even here, it is surprising how difficult it is to be quite sure that one sees what one thinks one

sees. To estimate correctly (*e.g.*) the relative length of two antennal joints seems a simple matter; yet even here the most practised eyes will sometimes be deceived. Again, the comparative length and breadth of the *gena* in a particular insect is a definite fact; yet unless it be placed in exactly the right position when we measure it, the best micrometer will measure it quite wrongly.

And as to infuscations, etc. of the wings, there are but few *Colletes*-species in which such characters can be employed to any purpose, and even in these species the phenomenon is apt to be inconstant.

Accordingly in constructing tables for *Colletes* based on such characters, I am simply making the most that I can of unsatisfactory materials. The fact is, that throughout the whole genus the external structure is particularly simple and uniform: strong paradoxical characters such as help us to classify other genera are here scarcely to be found* without dissection of the insects. And though in quite fresh specimens the colour and disposition of the pilosity in certain species may be adequate to distinguish them for certain, a slight amount of fading or rubbing will make almost any *Colletes* practically unrecognizable by such characters. Whatever its original colours may have been, it speedily bleaches into a dull uniform grey. The fasciæ which now look white may once have been distinctly yellow; and those which are now widely interrupted, may or may not have once been entire. Hence, if we are to determine at all any but exceptionally perfect specimens, we can do so only by employing structural characters; and these in *Colletes* are, as we have seen, for the most part minute, easily misinterpreted, and still more easily misrepresented when we try to express them in a verbal description.

If then my Tables prove to be of practical use to hymenopterists, I shall be glad; if not, I shall not be much surprised.

The length of the *gena* being perhaps the most conspicuous of the external characters, I have taken it as my first ground of division. But I do not at all think that it divides the species into real natural groups. (Cf. the figures of *genæ* in Plate VI, which, different as they are, belong all to insects which I believe to be nearly

* The scutellar appendages of *græffei*, Alfk., are an isolated exception.

related.) Certain differences of pilosity (*e.g.* nearly naked or, on the contrary, almost villose discs of the abdominal segments) are perhaps of real phyletic significance, but all sorts of intermediate conditions occur, and I prefer as far as possible to employ characters which depend less on the freshness, etc. of the particular specimens examined. As to my measurements of antennæ, legs, genæ, etc., I have made them with great care; but I cannot hope that I have always avoided errors, for when such objects are measured microscopically, the slightest inaccuracy in placing them produces a fallacious image, and falsifies the measurement accordingly.

TABLE OF EXTERNAL CHARACTERS.

1. Genæ extremely long, their (least) longitudinal diameter quite twice the breadth of the mandible at its base	2.
Genæ evidently elongate, but decidedly not twice as long as the base of the mandible is broad	3.
Genæ subquadrate, their (least) length about equalling the breadth of the mandible	5.
Genæ transverse or short, two-thirds as long as the breadth of the mandible or less	15.
(For the above characters, consult the Figures of genæ and heads in Plates VI and IX.)	
2. Abdomen coarsely and rugosely punctured.	
Face, between eyes, very long, narrow and parallel-sided. (Pl. IX, 36)	15. <i>nasutus</i> , Smith.
Abdomen with minute distinct punctures. Face very long, but wide above, the eyes converging. (Pl. IX, 39)	34. <i>formosus</i> , Perez (? = <i>lacunatus</i> , Dours).
3. Abdominal fasciæ definite and conspicuous	4.
Fasciæ indefinite or absent. Large, circ. 15 mill. long	33. <i>cucicularius</i> , Linn.
4. Second abdominal segment clothed on its disc above with long pale hairs. All the fasciæ wide. Species rather small, circ. 10 mill. long	16. <i>coriandri</i> , Perez.
Disc of second abdominal segment with short fuscous hairs. Fasciæ towards the apex of the abdomen becoming very narrow. A much larger species than the last, circ. 13 mill. long. Cordiform area of the propodeum with a narrow shining triangle forming its apex, but its base and disc occupied by a series of transverse parallel rugosities (Canary Islands, etc.)	5. <i>dimidiatus</i> , Brullé.
5. Sixth ventral plate with a well-defined small and deep oval fovea, impressed transversely on each side of its disc, some way from the sides and apex of the segment. (Pl. IV, 52)	6.
Sixth ventral plate without such definite discal foveæ, though sometimes broadly depressed or excavated on each side of a central carina. (Cf. Pl. IX, 53)	7.

6. Punctures of basal abdominal segment above much larger and coarser than those of the second segment. Fasciæ rather wide and in fresh specimens generally more or less yellowish. Circ. 11 mill. long. (Universally distributed species, ranging from North Europe to Egypt, and common everywhere) 30. *succinctus*, Linn.
- Puncturation much more uniform and very fine. Fasciæ narrow and white. A larger species, circ. 13 mill. long. (Mediterranean region) 29. *frigidus*, Perez.
7. Sides of seventh dorsal plate of abdomen much constricted, making its apex somewhat mucronate (Pl. IX, 43a) 32. *acutus*, Perez
- Seventh dorsal plate shaped otherwise 8.
8. All the abdominal fasciæ entire, broad, and uniform 9.
- Some at least of the fasciæ are narrow, or interrupted, or obsolete 12.
9. Very large, circ. 15 mill. long. Disc of second dorsal plate with long pale hairs 14. *bracatus*, Percz.
- Much smaller. Second dorsal plate not very pilose, apart from its fasciæ 10.
10. Very small, circ. 7 mill. long. Wings opalescent with pale reddish-yellow stigma and nervures. Hairs of head and thorax above white 11.
- Larger, circ. 10 mill. long. Wings simply hyaline with darker stigma and nervures. Hairs of head and thorax above pale brown (Greece) 3. *cccrops*, n. sp.
11. Third abdominal segment punctured much like the second. Fasciæ quite as broad as the spaces between them (Egypt, Tunis) 21. *nanus*, Friese.
- Third abdominal segment punctured much less closely than the second. Fasciæ distinctly narrower than the spaces between them (Algeria) 22. *punitus*, n. sp.
12. Six well-defined abdominal fasciæ, the fifth more or less narrowed laterally and the sixth extremely narrow throughout. Circ. 10 mill. long (Greece, and South Italy) 17. *phalericus*, n. sp.
- Either the fasciæ are more or less indistinct or even absent; or, if well defined, those towards the apex are as broad as those preceding them 13.
13. The whole clypeus except its extreme apical margin is strigose longitudinally and strongly punctured between the strigæ 26. *montanus*, Morawitz.
- Part at least of the sides and apex of the clypeus are smooth with only a few large sparse punctures 14.
14. Fasciæ almost obsolete; punctures of abdomen intensely fine and sparse, apex of basal segment almost impunctate 31. *impunctatus*, Nyl (= *alpinus*, Mor.).
- Fasciæ distinct, punctures of abdomen, though fine and sparse, are much less so than in *impunctatus*, and the apex of the basal segment is punctured throughout 25. *mongolicus*, Perez.
15. Scutellum with conspicuous unicolor lateral processes (Pl. IX, 45). Wings dusky. Metatarsus posticus very broad 28. *graffei*, Altken.
- Scutellum simple 16.

16. Dorsal surface of abdomen peculiar, showing in places a sort of irregular transverse rugulosity or striolation together with numerous very shallow punctures. The latter vary in shape and size, and have rather ill-defined margins. They are partly "elevated," and sometimes become almost confluent transversely. The extreme apices of the segments are smooth and whitish. Their discs are clothed with pretty long suberect hairs. The colour of the pilosity seems to be mainly cinereous, that on the thorax rather fuscous than fulvous (but all my specimens are much faded). The sixth ventral segment has a well-marked central carina. The labrum is scarcely tuberculated or foveated. The anterior and intermediate tarsi seem particularly long and slender, scarcely half as broad as the posterior. The insect is rather large, circ. 13 mill. long. The wings sometimes (but not always) evidently with a yellowish stain 35. *cariniyer*, Perez (? = *collaris*, Dours).
- Punctures of abdomen above either large and strong, or, if fine, at least pretty deep and well-defined (circular) upon a smooth ground ... 17.
17. Discs of intermediate abdominal dorsal plates clothed with longish sub-erect hairs. Intermediate joints of tarsi postici considerably dilated, cordiform, at least half as broad as long (Pl. IX, 59, 60, 61) 18.
- Discs of intermediate dorsal plates very shortly pubescent or naked. Intermediate joints of tarsi postici narrower, evidently not half as broad as long (Pl. IX, 62, 63) 21.
18. Intermediate joints of tarsi postici broader than long. Wings faintly clouded. Discs of abdominal dorsal plates strikingly hirsute. A large Mediterranean sp. 12-13 mill. long... 11. *abeillei*, Perez.
- Intermediate joints of tarsi postici not or scarcely as broad as long. Species smaller, and all occurring commonly in northern districts 19.
19. Puncturation fine and sparse. Fasciæ narrower, the hairs forming them scarcely half as long as the erect hairs on the disc of second segment. Sixth ventral plate dentate laterally and not carinated in the centre (Pl. IX, 50) 18. *daviesanus*, Smith.
- Punctures much closer and stronger. Fasciæ wider, their hairs about as long as the erect pilosity. Sixth ventral plate evidently carinated in the centre (Pl. IX, 53) 20.
20. Second joint of tarsi postici (Pl. IX, 60) more produced and dilated at the apex exteriorly, making the very oblique apical margin as long as the interior. Antennæ longer. Fasciæ of a purer white. (Pilosity of body and legs a little shorter and less copious) ... 19. *picistigma*, Thoms.
- Second joint of tarsi postici (Pl. IX, 61) less dilated and produced, the apical margin is therefore less oblique and evidently shorter than the interior. Fasciæ with a creamy tinge. Antennæ shorter 12. *folicus*, Kirby.

21. Wings distinctly clouded with fuscous-yellow... .. 23.
 Wings clear or nearly so 23.
22. Larger, circ. 13 mill. long. Abdomen finely punctured on a smooth shining ground, with narrow white fasciæ 20. *spectabilis*, Morawitz (= *niveo fasciatus*, Dours).
- Smaller, circ. 10 mill. long. Abdomen very coarsely sculptured, with large rugose punctures, and strong (*Cerceris*-like) abrupt constrictions between the discs of the segments
23. Third joint of antenna as long as the fourth. A small insect with short antennæ, and very short genæ (their least length is not a fourth of the width of the mandibles). Sixth ventral plate with a pilose tuberculation at each lateral angle and a wide pale apical margin. Pedes postici with very slender tibiæ and tarsi 13. *punctatus*, Mocsáry.
- Third joint of antenna evidently shorter than the fourth. Genæ at least a third of the width of the mandibles, often much more 24.
24. Fifth ventral plate punctured (subrugosely) all over—the punctures seem both larger and closer than those on the preceding segments. Cordiform area of propodeum for the most part longitudinally rugose, somewhat obliquely 24. *brevicornis*, Perez.
- Fifth ventral plate otherwise punctured 25.
25. The disc of the fifth ventral plate (*see* Pl. IX, 51) is occupied by a large impunctate triangular space, nearly equilateral, whose sides, defined by dark lines, converge from the base of the segment to near its apex, where the triangle ends in a small pale rounded fovea. Outside this triangle the surface is punctured and pilose. (A small Mongolian sp. circ. 8 mill. long.) 24. *marginatus*, Smith.
- Fifth ventral plate sculptured otherwise 26.
26. Sixth ventral plate (Pl. IX, 49) with a rather conspicuous oval patch of dense dark-looking pilosity bordered by an oblique fovea near each of its lateral angles. Last dorsal segment slightly incised at apex (sub-bilobate) Sixth ventral plate without conspicuous pilose patches as above; at most with a thin loose tuft or pencil of pale hairs 6. *ligatus*, Er.
27. The whole abdomen, including its basal segment, very closely, finely, and evenly punctured above, so that the surface is uniformly almost dull 27.
- The puncturation is much less close and regular, with shining intervals, on the basal segment it is conspicuously larger and more sparse than on those following 28.
28. Slightly larger and especially broader than the next species, circ. 12 mill. long. Fasciæ broad and yellowish. Hairs of thorax above rich fulvous-red. Eyes very slightly converging (Egypt) 4. *perezii*, n. sp.
- Fasciæ somewhat narrower and snow-white. Hairs of thorax above cinereous yellow. Eyes rather strongly converging, making the face look more triangular and the clypeus narrower (Algeria) 9. *ctaoni*, n. sp.

29. Middle joints of antennæ (Pl. IX, 54) about as broad as long (they seem to be flattened in a peculiar manner beneath). Face very short and broad, differing evidently from all the following species, except perhaps *caspicus* (See Pl. VI, 8a and 10a). A small species, circ. 7 mill. long. (S. France) 10. *chobauti*, Perez.
 Middle joints of antennæ considerably longer than broad. Species larger 30.
30. Area trigona of propodeum crossed by large clathrate rugosities, its lateral areas also largely rugose, looking in some lights almost strigose. Eyes not very convergent. Apex of seventh dorsal plate narrowly rounded, almost pointed 7. *hylaiformis*, Eversm.
 Disc of area trigona mostly quite smooth; the lateral areas punctured, rugosely, but with no appearance of strigosity 31.
31. Apical half of sixth ventral plate abruptly depressed; its central part is pale shining and almost impunctate. Face wide and short with eyes converging strongly: the vertex elevated. Dorsal apex much as in *hylaiformis*. Hind tarsi rather wide—the first joint not above *four* times as long as broad (*six* times in the species following!) 8. *caspicus*, Morawitz.
 Sixth ventral plate less sharply sculptured, and its central part evidently rather largely punctured. Apex of last dorsal plate wider, subtruncate, with a slight central incision. Face squarer, the eyes converging only slightly. Lateral areas of propodeum not so strongly and closely punctured { 1. *balteatus*, Nylander, &
 { 2. *eous*, n. sp.

I can at present give no external character that satisfies me for separating these two. (See below, Notes on the Species.)

NOTES ON THE SPECIES FIGURED.

Species with unincised stipites 1–10.

1. *Balteatus*, Nyl. (?). Pl. VI, fig. 1, 1a, 1b. Pl. IX, figs. 63, 64.

I call this species *balteatus* on the authority of Prof. Perez and several other correspondents from whom I have received it. But whether it is really Nylander's species I do not know. If, as I believe, it does not occur in Northern Europe, it obviously cannot be the *balteatus* of Thomson.

Nylander first proposed *balteatus* as a name for Latreille's *succinctus*, which he considered not to be the *succinctus* of Linné. But I can find nothing either in Latreille or Nylander to show what the insect really was which Latreille called *succinctus*. Several species seem to me

to suit all that is said by either author quite as well as the present.

Radoszkowski's *balteatus* is certainly *marginatus*, Smith, and I believe Thomson's is the same.

In its armature and seventh ventral segment the present insect resembles very closely the four species next to be figured. But it differs in that the stalks or petioles from which the lobes of the seventh ventral plate spring are *evidently pilose*. They have a continuous ciliation of well-developed hairs, proceeding from definite punctures, which commences nearer the base of the segment than the point at which the lobes begin to spread from it.

In the armature all five species agree (*a*) in the narrow elongate *un-notched* stipites, which contract very gently in the dorsal aspect, but rapidly in the lateral (Pl. IX, 64), to form the slender and very pilose apical process; (*b*) in the manner of folding (rather than the actual outline which depends on a variety of accidents) of the dilated sagittæ. The more transparent part of this (the "fourreau") consists of *two laps* (one basal, the other apical) *which partly cross each other*, and in so doing produce the effect of a triangular sub-opaque thickening of the membrane. These laps are further overlapped by a *third fold* which is *chitinous and triangular*, occurring at the point where the sagittæ (viewed laterally, Pl. IX, 64) are bent downwards almost at a right angle, and this is really about half-way between their bases and their apices, though in the dorsal view the deflected apical halves are so foreshortened that this is not easily realized. Between the bases of the sagittæ and the stipites the volsella peeps out, of course at a much lower level, and therefore only to be seen properly by altering the focussing.

All this group agree as to the seventh segment in the *gradual* dilatation of sub-triangular and petal-like lobes from elongate stalk-like and apically sub-acuminate interior "costæ." The clouding, etc. of these lobes is also very similar. They differ chiefly in their *degree* of dilatation (more or less rapid) and in the outline of their actual apical margin, to see which properly, however, the object must be viewed in more aspects than one.

In external characters they agree in being all very shortly haired on the discs and conspicuously banded at the apices of the segments. The fasciæ are entire, and there is usually—perhaps always—a distinct basal fascia

also on segment 2. The legs in all are rather slender, and the third antennal joint is always shorter than the fourth. In puncturation they differ considerably, and also in the length of the genæ, the sculpture of the propodeum, and the structure of the apical segments both dorsal and ventral. These differences seem enough to separate them as distinct species, but I feel sure that they must be very near relations.

Balteatus seems to be a fairly common and widely distributed species in the Mediterranean and also in the Alpine districts (Spain, S. France, the Adriatic, Switzerland, Tyrol, etc.). I have taken it quite high up on the Simplon Pass. It is not British, nor (I believe) does it occur in Scandinavia or North Germany—hence it is unlikely that Thomson's *balteatus* is this species.

Though Radoszkowski figures our *marginatus* as "*balteatus*, Latreille" (sic),* he also figures what I think must be the present species under the name "*marginatus*," which name of course it cannot bear in any case.

Prof. Perez at one time identified this species with *lacunatus*, Dours, under which name it is placed in some collections. But Dours's description does not suit it in the least, and M. Perez tells me that he accepted the identification on the faith of a correspondent, and has now abandoned it.

A correspondent sent me a ♂ and ♀ of this species as "*sierrensis*, Frey Gessner," and I have myself taken it *at Sierre!* But I have not seen Frey Gessner's types, and another insect that has come to me under the same name is certainly *marginatus*, Smith. If *sierrensis* really = my *balteatus*, I should be inclined to adopt the former name, as there really seems no particular reason for identifying our insect with Nylander's species.

2. *Eous*, n. sp. (?). Pl. VI, 2, 2a.

Species a *balteato* vix distinguenda, nisi segmenti septimi ventralis lobis magis elongatis, apicem versus minus dilatatis, margine apicali vix sinuato, et præcipue petiolis loborum nudis (nec ciliatis nec punctatis), fortasse quoque numero (13) hamulorum in alis inferioribus. ♂ long. circa 10 mill., ♀ latet.

Helenensdorf, Transcaucasia (?), Pola (?).

* *Balteatus*, Latreille, is a nullity. *Succinctus*, Latreille = *balteatus*, Nylander.

I am rather unwilling to separate this from *balleatus*, with which it agrees in almost every particular. But the difference in the seventh ventral plate is remarkable. (Prof. Perez has seen my dissections and agrees with me as to this.) The lobes are differently shaped, and their petioles are absolutely impunctate and unciliated. To this I may add, that in the one specimen whose *external* characters I have examined for this paper—two others I seem to have unfortunately mislaid, and can at present only find the *dissections*—there are thirteen hooks in each wing (a number which also occurs in all my specimens of *perezii*), whereas in *balleatus* I have never found more than eleven. But I fear this character is not reliable, for my solitary specimen of the next species (*cecrops*) has thirteen hooks in one wing and eleven in the other!

Whether *cous* is a true species, I must leave to be decided by those who can tell me what "a true species" really is. But I have found the pilosity of the concealed segments so constant a character in all the genera in which I have examined it, that for the present I must regard it as specific. The absence of the characteristic hairs in my specimens of *cous* is not due to accidental depilation, for the punctures from which they should originate are wanting also.

My one remaining entire specimen of *cous* ♂ is from Helenensdorf, Transcaucasia, sent me by Herr Koul of Vienna. It is not in such a condition that I can say whether in fresh specimens it might be distinguished from *balleatus* by external pilosity-characters. In structure, except as to the alar hooks and the naked "petioles" of the seventh ventral plate, I have failed to find any difference between them that I can regard as clearly specific, and unfortunately I do not know *cous* ♀.

3. *Cecrops*, n. sp. Pl. VI, 3, 3a, 3b.

Balleato simillimus, cum quo facile confundi potest, sed genis multo longioribus (pæne quadratis!), etiamque segmenti ventralis septimi petiolis bases versus haud ciliatis, ut opinor, certe discedens.

This insect again comes exceedingly near to *balleatus*, but its genæ are evidently longer, so that in my Table it is placed among the species with sub-quadrated genæ. They are also irregularly rugose, or rugosely punctured, longitudinally almost all over, while in *balleatus* there is a wide

smooth space between the basal rugosities and the apex. The *apical* part of the "petioles" in the seventh ventral plate is very densely ciliated with pale whitish hairs, but not in the style of *balteatus*, where the hairs are looser, darker (I think), and commencing much nearer to the base of the segment.

If a distinct difference in the length of the genæ is not to be regarded as a positive specific character in *Colletes*, it is hard to see on what grounds we are to establish species among them at all: if it *is*, then certainly *ccerops* and *balteatus* differ. Thus we come back to the question, "What is a species?" to which, for my part, I know no thoroughly satisfactory answer. In the meantime, I hold *ccerops* to be distinct.

I have only one specimen (♂), taken by myself in Attica (April 30, 1901).

4. *Perezi*, n. sp. Pl. VI, 4, 4a.

♂ *Balteato* affinis, sed maior (10-13 mill. long.), abdomine longe subtilius æqualiusque punctato (propterea magis opaco), fasciis abdominalibus latioribus, flavidis subsquamosis. Segmenti ventralis septimi petioli nudi, basibus dilatatis. ♀ (long. circa 15 mill.) a *balteato* ♀ notis iisdem, quibus mas, differre videtur.

Aegyptus, prope Cairo, iv et v, 1896.

This is a species which, though it has almost all the other characters of *balteatus*, distinguishes itself at a glance by its exceedingly different puncturation. This is intensely fine and close throughout, making the discs of the abdominal segments look remarkably opaque. The fasciæ also are seen at a glance to be very much wider. These in fresh specimens are decidedly flavescent, and formed of more than one distinct row of very thick (almost scale-like) branched hairs. It is rather larger than *balteatus*, and has thirteen alar hooks. I know it only from Egypt, where I have taken both sexes near Cairo. Possibly it may be identical with some of the species described by Spinola (e. g. *intricans*, not however if Radoszkowski rightly identified that species!), but I cannot fit it satisfactorily to any of them. I have named it therefore after Professor Perez, in acknowledgment of much kind assistance received from him during this inquiry.

5. *Dimidiatus*, Brullé. Plate VI, 5, 5a, 5b.

The largest species of the group, and very distinct by its

exceedingly long cheeks, sparsely punctured, shining abdomen, and narrowish white fasciæ (especially those towards the apex). The sculpture of the propodeum is also somewhat peculiar: its base is occupied by clathrate rugosities, or rows of adjacent foveæ, which gradually diminish, and become vaguer as they approach the narrow shining triangle at its apex.

I know the species only from the Canaries, etc. (the region from which came also Brullé's types).

(In the ♀ the genæ are not particularly long, less so decidedly than their greatest breadth. In the ♂ they look even longer than they are in proportion to their breadth, an effect which seems to be due to their convexity, or to something in the disposition of the hairs. In the armature figured the apices of the sagittæ were unluckily distorted by pressure of the cover-glass. Normally I think they would look much as in the other species, almost linear—being viewed in profile only.)

6. *Ligatus*, Er. Pl. VI, 6, 6a, 6b. Pl. IX, 49.

The name *ligatus* was first employed by Illiger, who however did not describe his species. Erichson's description is of a ♀ from Spain, and, as is usual with these early descriptions, would suit equally well a number of species. Following Prof. Perez, I adopt the name for a species of which I have dissected three or four ♂♂ from various Mediterranean districts (that figured is from Barcelona, and Erichson's description is fairly suitable for it, though inadequate).

The ♂ has a strong external character in the well-marked dense tufts, in some lights looking almost velvety, which adorn the lateral angles of the last visible ventral segment. It is finely and rather sparsely punctured with shining interspaces.

This species, and the four which follow, agree with the last five in having the stipes *unnotched*, but differ from them in having the lobes of the seventh ventral plate much more transverse, and developed more abruptly, so that one may distinguish in them a basal as well as a lateral exterior margin (they might be called *quadrilateral*, the others being *trilateral*). But what is still more conspicuous is that they spring not from elongate "petioles," but from comparatively broad and stumpy "trunks." (The condition

in *ligatus* is somewhat transitional, in the others it is impossible not to recognize it instantly.)

The armature of *ligatus* is not unlike that of the previous species (*balteatus*, etc.), but differs in the much greater (broader and longer) triangular chitinous dilatation of the sagittæ at their point of deflexion. This occupies a much larger part of their dorsal aspect, and looks nearer their bases than the smaller (apical-looking) triangles in the other species.

The colour of the seventh ventral plate is very dark, making the broad hyaline space at the apex of each lobe particularly conspicuous. All my specimens have the same bold oblique (downwards and inwards) curl or roll of the lobes. It seems hardly possible to flatten them out completely without splitting them by the pressure. So they must be somewhat rigidly chitinized in parts.

7. *Hylæiformis*, Evr. Pl. VI, 7, 7a, 7b. Pl. IX, 46.

8. *Caspicus*, Morawitz. Pl. VI, 8, 8a, 8b, 8c. Pl. IX, 47.

I shall treat of these two species together, as they seem near allies, and their synonymy is at present somewhat entangled.

The questions whether and how they differ are best determined by consulting the writings of Morawitz who was the original describer of *caspicus*, and who also wrote a careful re-description of *hylæiformis* from examination of Eversmann's type-specimens, the original description being, he tells us, altogether inadequate.

The conclusions to which a study of these descriptions brings me are supported by the evidence of specimens received under the names respectively of *hylæiformis* (from Prof. Perez and Herr Kohl) and *caspicus* (from Prof. Perez only). *Hylæiformis* ♀ is at once separable from *caspicus* ♀ by its thoroughly squamose style of pilosity, and *hylæiformis* ♂ from *caspicus* ♂, both by the external characters given already in my Tables and (at a glance) by the armature, in which each apex of the unnotched stipes is narrow and elongate in *hylæiformis*, while in *caspicus* it is a broad, blunt, almost equilateral triangle. (See Pl. IX, 46 and 47.)

The species, however, which Radoszkowski calls *hylæiformis* (and also his *floralis*, probably not = the *floralis* of Eversmann!) is figured with an evidently blunt and short

apex to the stipes. As Radoszkowski has no species called *caspicus* in his Revision, while Morawitz, as we have seen, knew thoroughly both species, I feel practically certain that Radoszkowski dissected a *caspicus* not knowing it to be such, and wrongly assigned it to *hylæiformis*. And what he called *floralis* was probably another specimen of the same insect, indeed he himself suggests this as probable. (The true *floralis* seems, from what both Eversmann and Morawitz say of it, to have been very different from either *caspicus* or *hylæiformis*, and very likely did not belong to the group of *unnotched* stipites at all. But what it was, I have no idea. It must be a very small insect: 7-8 mill. sec. Morawitz.) Therefore, I think *hylæiformis*, Rad. (*nec.* Eversm., *nec.* Moraw.) is a synonym of *caspicus*, Morawitz.

Several of Radoszkowski's figures might possibly be referred to the true *hylæiformis*, e. g. his *anceps*, *mixta*, and *carinata*, are all more or less suggestive of it.

I never took *hylæiformis* myself, but have met with *caspicus* in several Mediterranean countries, and received it from others and also from Transcaucasia. It seems to be widely distributed, therefore, and probably is one of the common species of its group. Prof. Perez takes it at Royau, near Bordeaux.

The sagittæ of *hylæiformis* and *caspicus* seem very similar. Their most striking character is perhaps the large tooth-like fold of sub-opaque (but not thoroughly chitinized) substance which spreads out from them near the bases, overlying and partly hiding the base of the more transparent "wing." Above this fold is another dilatation of the sagitta, less conspicuous in the dorsal aspect because seen only in profile, but also looking denticiform when viewed laterally. This is more solid—in fact it is completely chitinized and black. It appears to correspond, though its situation is very different, to the triangular dilatations at the bend of the sagittæ in *baltatus*, etc.

In both species the lobes of the seventh ventral plate spring from short broad bases—not elongate petioles. In most of my specimens the outer apical corners are curled or rather creased diagonally into a sort of "dog's-ear," and when this happens the segment assumes an outline which always reminds me of a bishop's mitre as represented in heraldry. As compared with *ligatus* the lobes are more

elongate, and the sinuation of their apical margin hardly so strong. Their discs are also as a rule much less deeply infuscated.

Two further points about the synonymy of *hylæiformis* are puzzling.

(1) Morawitz says that the species is probably identical with *nasutus*, Smith. Yet as he describes it, it is evidently as different as possible from the latter, which is perhaps the most unmistakable species of the whole genus. I can only suppose that Morawitz did not know the real *nasutus* when he revised Eversmann's collections.

(2) V. Dalla Torre gives "*hylæiformis*, Perez," as probably = *acanthopygus*, Dours. But certainly the *hylæiformis* ♂♂ I have received from Prof. Perez and Herr Kohl by no means answer to Dours's description of *acanthopygus*. The latter should have a strong spine at the apex of the abdomen. Such a spine in a *Colletes*-sp. I never saw. Is it possible that Dours has been deceived by some ♂ in which a stipes of the armature accidentally protruded from the abdomen? (His "types" seem to have disappeared.)

9. *Eatoni*, n. sp. Pl. VI, 9, 9a, 9b.

Simillimus caspico, sed abdomine multo subtilius et æqualius densissime punctulato. Pilositas mesonoti pallida, non nihil flavescens. Fasciæ abdominalis densæ, latissimæ, niveæ, in ♀ vix minus quam in *hylæiformi* squameæ. ♂ stipitibus ut in *caspico* formatis, scilicet apicibus haud productis sed oblique truncatis. Genæ breves. (Corp. long. ♂ circa 10 mill., ♀ circa 12 mill.)

This beautiful insect is closely allied to *caspicus* by the structure of its armature and seventh ventral plates, but easily distinguished from it in both sexes by the extremely fine, close and even puncturation of the abdomen, and in the ♀ by the shorter and paler pilosity, which on the abdomen, though not on the thorax, is almost as squamiform as in *hylæiformis*. It appears to me to stand to *caspicus* much in the same relation as *perezi* to *balteatus*. The first abdominal segment is densely clothed at the base with white pilosity; there is also a dense basal band on the second segment, which, as well as all the apical fasciæ, is entire, very broad, and of the purest silvery-white; the pubescence on the discs of the segments is very short and dark, making the fasciæ show up very sharply in contrast

with it. The ♂ sixth ventral plate resembles that of *caspicus*, it has pretty long but not very thick penicilli at its lateral angles, a scarios margin, and a smooth pale longitudinal space in the middle of the disc. In both sexes the thorax above has a close and very even (as though shorn) pilosity, paler than in *caspicus*, being rather yellowish-brown than fulvous. Beneath, and on the face, propodeum, and legs, the hairs are pure silvery-white. Other characters are given in my Tables.

The specimens examined, the only ones I have seen, were taken in Algeria by the Rev. A. Eaton, after whom I have named it.

Radoszkowski's figure (in *H. E. S. R.*, v) of his *C. kirgicus* much resembles the ♀ of *eatonii*; but its wings look very dark, while they are quite clear with pale nervures in *eatonii*. And his description is so inadequate, that I cannot even be sure to what group even his species really belongs. He described only the ♀.

10. *Chobauti*, Perez. Pl. VI, 10, 10a, 10b. Pl. IX, 54.

A small species from South France kindly communicated to me by its author; and the last known to me of the section with "unnotched stipites."

In the seventh segment the base reminds me most of *caspicus*, the apex of *ligatus*. The armature seems very distinct by the very broad, well-developed "fourreau," with its appearance of a strong narrow (almost linear) chitinizing of its substance near the base of each exterior margin, by the slighter triangular sub-chitinous dilatation which overlies the fourreau, and by the apices of the stipites which have neither the very elongate character of those in *hylæiformis* and *ligatus*, nor the short, broad, triangular form of those in *caspicus* and *eatonii*.

Externally the structure of the head and antennæ, together with its small size, separate it easily from anything known to me.

Species with *notched stipites* 11-35.

11. *Abcillei*, Perez. Pl. VII, 11, 11a. Pl. IX, 59.

This species also I have received from the author. Both in the armature and the seventh ventral plate it seems to have some affinity with the species following, and

externally both are pilose, strongly punctured insects, with short cheeks, rather short antennæ, and dilated tarsi. But *abeillei* is much the larger species.

In the armature of *abeillei* the "apical process" of the stipes is short and inconspicuous (except for its dense but rather short pilosity); the "middle part," *i. e.* that above the "notch," is rather elongate, and has a pointed look, the outer margin (or rather "horizon") curving inwards towards the apex as though to meet the straight inner margin at an angle of about 30°. The sagittæ are only moderately dilated near the base, but the fourreau is particularly large and solid-looking; it is very wide at the apex, not only extending close up to the stipes, but curling round and returning thence towards the middle of the armature—doubled back over itself, as it were. Besides this doubling of the membrane, which alone would make it somewhat opaque, it has an actual dark stain over a considerable part of its substance, and appears even to some extent chitinous. The whole colour of this armature is unusually dark, and the seventh ventral plate, except its extreme apical border, is dark also, its lateral thickenings or "costæ" almost black. The form of this segment is rather simple; its lobes are wide and sub-triangular, with the corners rounded off, their surface slightly concave (ventral view), but not strongly curled up at the sides as in *ligatus*, etc., their actual apical margins straighter perhaps than in any species of the group, though the apical outline of their infuscated discs is evidently sinuated.

12. *Fodicus*, Kirby. Pl. VII, 12, 12a. Pl. IX, 61.

This is a common British species, and I have taken it also in Switzerland. It often occurs on *Senecio*, and I have found it accompanied by *Epeolus productus*.

The armature is very distinct by the unusually elongate central portion of the stipites, their very inconspicuous and only slightly pilose apices, and the extremely dark "wings" of the sagittæ, which, however, are hyaline at the apices.

The outline and colouring of the seventh segment also distinguish the species immediately from any other. It is generally very dark as a whole—almost black in places, but with sharply-defined hyaline spaces at the apex and near the base. Its apical margins are gently sinuated in the middle, and gently rounded on each side of the sinuation. The segment is distinctly more produced in the

apical direction near its centre than at the sides—a character which appears more strongly still in the next species.

13. *Punctatus*, Morawitz. Pl. VII, 13, 13a.

My specimens (from Pest) were given me by Herr Friese. I never found it myself.

The armature and seventh ventral plate have a certain resemblance to those of *fodiens*. But their colour is much paler; the stipites are very differently formed, their central portion being comparatively short and broad, while the apical portion on the contrary is very elongate and strongly pilose; there is a peculiar thickening of the membrane at each apical outer corner of the “wings” in the sagittæ; and the lobes of the seventh ventral plate are much more narrowly rounded at their apices—almost pointed.

A character common to this species and the two last is the truncate appearance (at the apex) of the “wings” of the sagittæ. This is unusual in the genus; the “wings” are generally either rounded apically or produced into a form resembling the point of a penknife.

14. *Bracatus*, Perez. Pl. VII, 14, 14a.

I have received this very large and handsome species from the author. Specimens taken by myself in Egypt agree with it exactly, both externally and in the characters of the armature and the concealed segments. These have been described by Herr Friese under the name *grandis*, but Prof. Perez’s name is the older, and must be adopted.

The form of the seventh segment and the disposition of its cloudings to a certain extent recall those of *fodicus*, but the apical margin has a different (double) sinuation, and the colour is extremely different—the lighter parts being yellowish, and the darker a beautiful orange-red.

The armature is quite unlike that of any preceding species. The stipites, indeed, are not unlike those of *punctatus*, but the sagittæ are altogether of another type. The “wings” are nearly clear, only faintly yellowish, and the more solid part has two distinct basal dilatations, the more apical of which is not—as is usual in such cases—dentiform.

15. *Nasutus*, Sm. Pl. VII, 15, 15a. Pl. IX, 36.

This is another very large species—one of the few which

can be distinguished at a glance by its external characters, the long parallel-sided face, etc.

Its armature and seventh ventral segment show affinities to those of *bracatus*, but the secondary dilatation of the sagitta (between the basal dilatation and the "wing") is very evidently dentiform.

The lobes of the seventh segment appear less transverse, partly perhaps because they curl inwards much more strongly; their cloudings are also very different.

The species examined were sent to me by Herr Kohl and Herr Friese.

16. *Coriandri*, Perez. Pl. VII, 16, 16a. Pl. IX, 37.

17. *Phalericus*, n. sp. Pl. VII, 17, 17a.

I treat these two species together, as their dissections are practically identical. Their external characters, however, separate them at once; especially their heads are constructed quite differently, so that they fall under different sections in my tables.

The simple almost circular lobes of the seventh ventral plate are unlike those of any other species known to me. The wings of the sagittæ are produced far beyond their apparent apices, much as in *daviesanus*, but with a different outline. There is a secondary dilatation—not dentiform—between the basal dilatation of the sagitta and its wing.

Coriandri is an Algerian sp. I have examined a ♂ determined by the author, and sent to me by M. Vachal, and another taken in Algeria by Mr. Eaton.

Phalericus I have taken freely in Greece and also in South Italy and at Cerbère—the eastern end of the frontier between France and Spain. Its diagnosis follows.

Niger, sed ♀ apice ventrali fere semper testaceo; nitidissimus, abdomine subtilissime omnium punctulato (in segmento basali disperse, in reliquis multo densius). Genæ in ♂ subquadratæ, in ♀ marginis transversæ. Antennarum art. 3^{tius} (♂) 4^{to} subæqualis. Mesonotum griseo-brunnescente (vix fulvido) mediocriter pilosus; segmentorum abdominalium disci fusco-subpilosi, apices decolorati, fasciis albis integris, quarum ultima (in ♂ saltem) longe angustior quam basales videtur (♀ segmentum abdominis secundum fasciam basalem quoque distinctam exhibit, quæ in maribus meis omnibus aut detrita est aut omnino deest). Segmentum ventrale ♂ sextum basi leniter bicallosum, reliqua segmenta ventralia apicibus plus minusve triangulariter in medio scariosis.

From the circumstance that the sixth ventral segment in the ♀ is almost invariably testaceous, it seems to me possible that this, and not the species I have above accepted as *ligatus*, is the species described under that name by Erichson. He gives this character, and I have not observed it in the ♀♀ of what I have called *ligatus*. But without a great deal more material I should not venture to do more than throw out this as a suggestion.

Prof. Perez has kindly sent me the dissected apex of a species which, after seeing my *phalericus*, he considers to be distinct from it. I do not see myself that the dissections differ from my own of *phalericus*. If the two species are identical, his name—*fovcolaris*, Perez—will have priority over mine.

But considering that *coriandri*, a very different species from *phalericus*, shows the same dissection characters, I am quite prepared to believe that *fovcolaris* is a third distinct species of the same group. As I have only seen its dissection, and not examined the insect itself, it does not of course appear in my Tables.

18. *Davicsanus*, Smith. Pl. VII, 18, 18a. Pl. IX, 41, 50.

The commonest species in this country, and widely distributed over Europe.

Its seventh ventral plate could only be confounded with that of *brevicornis*, from which species the greatly produced apices of the wings in the sagittæ distinguish it immediately. The external characters of the two species are very different.

19. *Picistigma*, Thoms. Pl. VII, 19, 19a. Pl. IX, 53, 60.

Not uncommon in certain localities in this country, it occurs also in the Alps, and Thomson describes it from Scandinavia.

The seventh ventral plate is extremely distinctive, it is curled laterally in such a manner, that (viewed either dorsally or ventrally) the lateral margins of the lobes look quite straight and perpendicular, they also seem to project in the basal direction beyond the basal margins of the lobes, forming with them a sort of angular incision in which appears a peculiar fringe of diagonal hairs. The apical margin of each lobe has a sort of tooth-like production before it meets the interior margin, which contrasts

strongly with the rounded outline of this part in *fodicus*, *daviesanus*, etc., and allies it rather to *succinctus*. The armature is, on the whole, not unlike that of *daviesanus*; but the apical productions of the "wings" in the sagittæ are less marked than in that species. Yet the difference seems to me hardly so great as the figures in Mr. Saunders's synopsis would suggest.

20. *Spectabilis*, Morawitz. Pl. VII, 20, 20a.

This is generally called *niveofasciatus*, Dours, and I have little doubt that the identification is correct. But I am also convinced that the female at least is that which Morawitz described as *spectabilis*; and as his description appeared before that of Dours, I adopt his name.

The forms both of its armature and seventh ventral segment are most peculiar, and distinguish it at once. Radoszkowski has luckily figured the latter along with the armature of his *niveofasciatus*; and though the figure is exceedingly rough, its outlines unmistakably indicate the present species.

As to the armature, it will probably suffice if I call attention to the elongate and attenuated character of all its parts, to the peculiar forceps-like prolongation of the apices of the sagittal "wings," and to the singular appearance of the volsella, which is much more prominent than usual—prominent even in the direct dorsal view.

I know the species from Greece, Italy, South France, and Spain.

21. *Nanus*, Friese. Pl. VII, 21, 21a.

This was originally described from specimens, ♂♂ and ♀♀, which I took in Egypt, near Cairo.

The armature and seventh ventral plate have a certain resemblance (but too slight to cause any confusion) to those of *spectabilis*.

The insects themselves have no similarity whatever, and could not possibly be confounded.

22. *Pumilus*, n. sp. Pl. VII, 22, 22a.

This is so like the last species externally, that until I dissected them I never doubted that the two were identical; and Herr Friese himself, on comparing my specimens with his types of *nanus*, at once declared them to be the same.

The armatures, however, and still more conspicuously the seventh ventral plates, make it impossible, I should say, to unite them. And having separated my specimens by these characters, I can now detect other slight differences in them which I mention in my Tables.

Personally I have taken *nannus* only in Egypt, and *pumilus* only in Algeria. But M. Vachal has sent me a specimen from Tunis, which I can only call *nannus*; so that probably that species occurs in Algeria also, though I did not meet with it there.

The almost equilaterally triangular lobes of the seventh segment in *pumilus* are quite unique in the genus, as far as I know it. Yet possibly we may see in them the beginnings of such a modification as has produced the extraordinary "tails" of *impunctatus* described below.

23. *Brevicornis*, Perez. Pl. VII, 23, 23a. Pl. IX, 38, 56, 62.

All my examples of this species are from the Alps. The author records it from Sicily.

I have mentioned above the likeness of its seventh ventral plate to that of *daviesanus*. The lobes, however, spring from more elongate and altogether larger basal "trunks," which give the segment as a whole a different outline.

It will be noticed that in my figure the apices of the stipites point *outwards*. But probably no stress should be laid on this, as these apices have certainly some power of independent motion in the living insect, and though in dried specimens they usually turn inwards, I have found occasional instances to the contrary among examples of other species.

24. *Marginatus*, Smith. Pl. VIII, 24, 24a.

As to the determination of this species there can be no doubt. Nothing occurs in this country which could be confused with it, and Smith's types were British insects. It seems to be very generally distributed over Europe, and I have dissected specimens from the most remote localities—one even from the interior of Asia—with precisely similar results.

The apices of the stipites, in this and several of the species following, look decidedly pale, broad, and rather triangular than palpiform even in the direct dorsal view.

Their middle part has a more or less bulging external outline—less noticeable, however, in this particular species than in some near it, e. g. *montanus*. The sagittæ have a very noticeable dentiform dilatation between the basal dilatation and the “wing.” The pilosity at the apex of each stipes is decidedly rather long and copious.

The seventh ventral segment in *marginatus* has a distinct facies of its own. Its outlines are rather angular than rounded—note especially the lateral projections towards its base. It is mostly nearly colourless, but with yellowish costal thickenings. Though it has certain points of likeness to the same segment in two or three of the other species, it could hardly, I think, be confused with any of them.

It is, perhaps, scarcely necessary to repeat that Radoszkowski's figure of “*marginata*, Smith,” has nothing to do with this species, but represents one of the *balteatus* group.

On the other hand, *balteatus*, Rad. (*nec*. Perez), certainly *does* represent our British species, his type having been received (as he tells us) as *marginatus* from Mr. E. Saunders, and his figure, though hardly good, being at least recognizable.

25. *Mongolicus*, Perez. Pl. VIII, 25, 25a.

I have received this species from the author, and also (unnamed) from Herr Kohl.

Its armature closely resembles that of *marginatus*, but the seventh ventral plate distinguishes it at a glance. This, alone among the species with “divided stipites,” has the sort of outline (long petioles and bilobed apices) which characterizes the *balteatus* group, and yet it could hardly be confused with any of them.

I cannot point to any case which illustrates better than the present the value of the characters of the seventh ventral plate for determination of obscure *Colletes* species. *Mongolicus* and *marginatus* both occur in Mongolia, and their armatures are practically not distinguishable. Yet by the seventh ventral plate, as well as by sufficient though minute external characters, they are unmistakably shown to be distinct species. And in a third Mongolian species, to be dealt with below, we have again the armature of *mongolicus* and *marginatus*, but a seventh ventral plate which separates it at once from either of them.

26. *Montanus*, Morawitz. Pl. VIII, 26, 26a. Pl. IX, 42.

This species has recently been found in Scotland. I have several times met with it in the Alps, and I suspect it is that recently described from Scandinavia by Aurivillius as *suecica*.

The armature is of the same type as *marginatus* and *mongolicus*. The dentiform secondary dilatation of the sagittæ near their bases is for some reason less conspicuous—I fancy the volsella obscures it somehow—but it certainly exists, though my figure hardly shows it. The outline of the stipites, in their central part, is particularly bulging.

The outline of the seventh segment distinguishes it at once from any species yet mentioned. We see, as it were, a pair of rather stout but elongate columns with dilated "capitals" and a sharp lateral projection—sharper than that in *marginatus*—on each side near their bases. (The lobes in *spectabilis* and *nannus* are also elongate, but otherwise very different, their form being rather oval than column-like.)

27. *Ventralis*, Perez. Pl. VIII, 27, 27a. Pl. IX, 51.

I have examined two specimens, both from Mongolia. One was sent to me by the author; the other I received from Herr Kohl.

By its dissection-characters it should be nearly allied to *montanus*, but it is much smaller, and the external characters differ considerably.

The armature hardly differs from those of the three last specimens. The seventh ventral plate is much in the style of *montanus*, but the "columns" here are decidedly more slender.

(I feel sure that *mongolicus*, *montanus*, and *ventralis*, and probably also *marginatus*, belong to a real group; and next to them I should place the American species figured in Pl. IX, 57, 58.) In this group (assuming it to be one), as in that of *baltcatus*, we find great differences in the length of the gena, making it probable (as suggested before) that this character throws little light on the *affinities* of species, though useful in distinguishing them *individually*.

28. *Græffei*, Alfken. Pl. VIII, 28, 28a. Pl. IX, 45.

I am enabled to figure this species through the extreme

kindness of Herr Friese, who actually allowed me to dissect his only specimen.

Its armature and seventh ventral plate seem to me as near to those of *marginatus* as to any other species. But the differences are considerable, and the unique external structure of the insect makes me think it better to consider it provisionally as standing alone in the genus. Should other species with toothed scutellum hereafter occur, it would be interesting to see how their "dissection-characters" compare with those of *græffei*.

29. *Frigidus*, Perez. Pl. VIII, 29, 29a. Pl. IX, 52.

30. *Succinctus*, L. Pl. VIII, 30, 30a. Pl. IX, 55.

In these two species—which agree *inter alia* in the peculiar foveation of the sixth ventral segment (Pl. IX, 52)—we come to a type of armature, etc. differing evidently very much from that found in *marginatus*, etc. The apices of the stipites are less conspicuous, more palpiform, and not nearly so pilose; the outlines of their central portion straighter—see especially the apical truncation and the exterior margin; the "wings" of the sagittæ are differently shaped, and though the latter have a secondary dilatation between the base and the "wing" it is not at all dentiform. The lobes of the seventh segment are not elongate but very transverse, recalling those in the neighbourhood of *bracatus* or *picistigma*, rather than those of *marginatus*, and differing "*toto cælo*" from those of *mongolicus* or *montanus*. In *frigidus* they are very hairy, and very small in proportion to the size of the insect. In *succinctus* they are much larger, nearly naked, and extremely transparent—so much so that under the microscope their apical margin, unless most carefully focussed, is apt to become altogether invisible. The costal thickenings in *succinctus* are of a beautiful and most delicate yellow; and the segment is altogether so frail and membranous that especial care is required to extract it undamaged.

Frigidus seems to be exclusively a Mediterranean species. My examples were received partly from the author and partly from Mr. E. Saunders.

Succinctus occurs universally from England and Scandinavia to Egypt, and its dissection-characters, as far as I can see, are everywhere the same.

In this country I nearly always find it on the purple

heather in late summer, but in Egypt I have taken it quite early in the year—on what plants I cannot remember, but certainly not on heather.

31. *Impunctatus*, Nyl. Pl. VIII, 31, 31a.

I feel no doubt that the insect from which I figure belongs to Nylander's species, nor that *alpinus*, Morawitz, is a synonym of the same. All my examples are from the Alps, where it is tolerably common.

The seventh ventral plate is most peculiar, and alone would distinguish the species at a glance. If we imagine the hairy transverse lobes of a *frigidus* contracted into a more quadrate shape, and furnished each at its inner apical corner with a long horn or tail of exceedingly thin transparent membrane, we should get the condition which we actually find in *impunctatus*. The armature is much more ordinary. Its stipites are formed nearly as in *montanus*, but the sagittæ have only a single basal dilatation; and their "wings" either are narrower, or are so folded as to look so, with a pointed rather than a rounded apex—but this last I take to be mainly an effect of "foreshortening."

No other *Colletes*—unless possibly *pumilus*—has a seventh ventral plate with anything even remotely approximating to the apical tails of *impunctatus*, and in that species both the armature and the external characters are altogether different. If *impunctatus* has really special affinities with any other *Colletes*-species, it perhaps comes as near to *frigidus* as to any; but I should be more inclined to place it in a special group of its own.

32. *Acutus*, Perez. Pl. VIII, 32, 32a. Pl. IX, 43, 43a.

I have two males and two females of this very distinct species, all from Algeria.

The seventh ventral plate seems to me to exhibit in a rudimentary form the paradoxical modifications which become stronger and stronger in the species which follow. The interior "costæ" are detaching themselves from the "lobes" to stand up as separate spike-like processes, and the commencement of a similar change seems indicated by the sharp sinuation—almost an incision—near each outer extremity of the apical margin.

In the armature I see nothing to call for special attention, except the very large and conspicuous *volsella*.

33. *Cunicularius*, L. Pl. VIII, 33, 33a. Pl. IX, 40, 48.

This being so common and well-known a species—rare perhaps nowhere except in our own islands—I will merely point out the unusually attenuated “wings” of its sagittæ, and the detachment of the “costæ,” both exterior and interior, from the lobes of the seventh ventral segment.

34. *Formosus*, Perez. Pl. VIII, 34, 34a. Pl. IX, 39.

35. *Cariniger*, Perez. Pl. VIII, 35, 35a.

In these extraordinary species, which must surely be nearly related in spite of considerable external differences, I may leave (I think) my figures of the dissection-characters to speak for themselves.

Formosus ♂, determined by its author, was sent to me by M. Vachal; *cariniger* I have taken myself in Egypt, and its female (I believe) in Spain, and I have also seen specimens (♂ and ♀) taken by the late Sir S. S. Saunders in the Balkan peninsula.

I am strongly inclined to think that *formosus* is the real “lacunatus” of Dours, and *cariniger* his “collaris.” Everything at all distinctive that I can see in Dours’s descriptions bears out this view; but as his types seem to have disappeared, and I do not know the ♀ of *formosus*, it is more prudent perhaps to adopt at present synonyms which are certain.

EXPLANATION OF PLATE VI.

(Characters of *Colletes* ♂♂.)

1.	<i>balteatus</i>	armature	1a	seventh ventral plate.
2.	<i>eous</i>	„	2a	„
3.	<i>cecrops</i>	„	3a	„
4.	<i>perezi</i>	„	4a	„
5.	<i>dimidiatus</i>	„	5a	„
6.	<i>ligatus</i>	„	6a	„
7.	<i>hylæiformis</i>	„	7a	„
8.	<i>caspicus</i>	„	8a	„
9.	<i>eatonii</i>	„	9a	„
10.	<i>chobartii</i>	„	10a	„

5b	<i>dimidiatus</i>	gena	6b	<i>ligatus</i>	head
3b	<i>cecrops</i>	"	8c	<i>caspicus</i>	"
1b	<i>balteatus</i>	"	9b	<i>eatonii</i>	"
7b	<i>hylæiformis</i>	"	10b	<i>chobanti</i>	"
8b	<i>caspicus</i>	"			

EXPLANATION OF PLATE VII.

(Characters of Colletes ♂♂.)

11.	<i>abeillei</i>	armature	11a	seventh ventral plate
12.	<i>fodicus</i>	"	12a	"
13.	<i>punctatus</i>	"	13a	"
14.	<i>bracatus</i>	"	14a	"
15.	<i>nasutus</i>	"	15a	"
16.	<i>coriandri</i>	"	16a	"
17.	<i>phalericus</i>	"	17a	"
18.	<i>daviesanus</i>	"	18a	"
19.	<i>picistigma</i>	"	19a	"
20.	<i>spectabilis</i>	"	20a	"
21.	<i>nannus</i>	"	21a	"
22.	<i>pumilus</i>	"	22a	"
23.	<i>brevicornis</i>	"	23a	"

EXPLANATION OF PLATE VIII.

(Characters of Colletes ♂♂.)

24.	<i>marginatus</i>	armature	24a	seventh ventral plate.
25.	<i>mongolicus</i>	"	25a	"
26.	<i>montanus</i>	"	26a	"
27.	<i>ventralis</i>	"	27a	"
28.	<i>græffei</i>	"	28a	"
29.	<i>frigidus</i>	"	29a	"
30.	<i>succinctus</i>	"	30a	"
31.	<i>impunctatus</i>	"	31a	"
32.	<i>acutus</i>	"	32a	"
33.	<i>cunicularius</i>	"	33a	"
34.	<i>formosus</i>	"	34a	"
35.	<i>cariniger</i>	"	35a	"

EXPLANATION OF PLATE IX.

36.	<i>nasutus</i>	head.
37.	<i>coriandri</i>	„ (lateral view).
38.	<i>brevicornis</i>	„ (lateral view).
39.	<i>formosus</i>	„
40.	<i>cunicularius</i>	concealed dorsal plates.
41.	<i>daviesanus</i>	volsella.
42.	<i>montanus</i>	„
43.	<i>acutus</i>	„
44.	<i>nasutus</i>	eighth ventral plate.
45.	<i>græffri</i>	side of scutellum.
46.	<i>hylæiformis</i>	stipes viewed laterally.
47.	<i>caspicus</i>	„
48.	<i>cunicularius</i>	„
43a.	<i>acutus</i>	seventh dorsal plate.
49.	<i>ligatus</i>	sixth ventral plate.
50.	<i>daviesanus</i>	„
51.	<i>ventralis</i>	fifth ventral plate.
52.	<i>frigidus</i>	sixth ventral plate.
53.	<i>picistigma</i>	„
54.	<i>chobanti</i>	antennæ.
55.	<i>succinctus</i>	„
56.	<i>brevicornis</i>	„
57.	<i>sp. ? (American)</i>	armature.
58.	„	seventh ventral plate.
59.	<i>abeillei</i>	tarsi postici.
60.	<i>picistigma</i>	„
61.	<i>fodicus</i>	„
62.	<i>brevicornis</i>	„
63.	<i>balteatus</i>	„
64.	<i>balteatus</i>	armature viewed laterally.